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MATHEMATICAL MODELING AND SIMULATION – FROM A SINGLE CELL TO THE HUMAN POPULATION

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ABSTRACT

Mathematical modeling and computer simulations of created models allow for a better understanding of biological processes on many levels, from individual cells to entire populations. Using them, we can not only reproduce experimentally observable behaviors of biological systems, but also formulate and test hypotheses that would be time-consuming or costly to test under experimental conditions. This paper will present examples of the use of mathematical modeling and computer simulations to study and analyze various properties of systems at different levels of complexity. From studying the impact of input timing on the behavior of individual cells, through the impact of stochastics in gene switching on the pharmacodynamics of drugs in tissue, the impact of drug resistance management strategies on the survival of cancer patients, to the impact of the spread of information about an epidemic in a population on its course.